

# A Solar Powered, Ceramic Oxygen Concentrator

Completed Technology Project (2012 - 2012)



## Project Introduction

Childhood pneumonia, which is treated with oxygen therapy, is a leading cause of death in children. Many children in developing countries lack access to medical oxygen. Existing oxygen concentrators are unreliable: one study noted 20 out of 20 concentrators failed in less than 6 weeks. JSC Engineering is evaluating a ceramic oxygen concentrator - because it is solid state it has the potential for good reliability. It is a new design and there are fewer than 12 units in existence, but one of the units has operated in a field hospital in Afghanistan, 24/7, for more than a year. Nobody has ever powered a ceramic concentrator (with this design) with solar power. We intend to integrate a solar power system and oxygen storage tank system with this new ceramic oxygen concentrator. We intend to integrate and test at JSC. If successful, the follow-up activity would involve testing in a challenging remote environment.

Oxygen is an essential treatment for several life-threatening conditions including pneumonia, the single biggest cause of death in children less than five years of age. Developing countries frequently lack access to the bottled, cryogenically formed oxygen used in Houston hospitals. Oxygen generators that use Pressure Swing Adsorption (PSA) methods are prone to system failure: one study reports that 20 out of 20 PSA units donated to a hospital in Gambia were inoperable after 6 weeks of use. There is a new oxygen concentrator technology that uses electrolytic oxygen transfer through a strong, ceramic, monolithic wafer. The system is capable of producing high purity (>99.9%) pressurized (200 psig) oxygen without a mechanical compressor. Because it is a solid state device, it shows good promise for reliable performance in demanding conditions. One unit has operated in a military field hospital in Afghanistan - powered by a diesel generator, it has operated 24/7 for 14 months with no shut-downs or failures. The technology is new: there are fewer than 12 ceramic oxygen concentrator units with this design in existence. NASA has three units. No ceramic oxygen concentrator (with the monolithic wafer design) has ever been powered by a solar power source. A ceramic oxygen concentrator, powered by a solar panel, has the possibility of safely and reliably delivering high purity, high pressure oxygen in demanding environments (like hospitals in developing countries or space exploration vehicles) - to date, nobody has developed or tested a ceramic oxygen concentrator that is powered by solar panels.

## Anticipated Benefits

The product will be the first ever solar powered, ceramic oxygen generation system, and the first set of performance test data for this new system.



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## Organizational Responsibility

### Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

### Lead Center / Facility:

Johnson Space Center (JSC)

### Responsible Program:

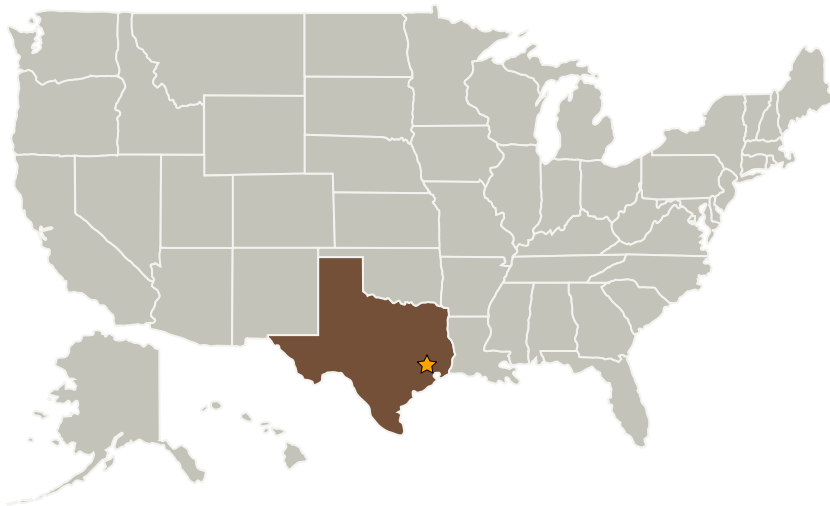
Center Innovation Fund: JSC CIF

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## Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
★ Johnson Space Center(JSC)	Lead Organization	NASA Center	Houston, Texas

## Primary U.S. Work Locations

Texas

## Project Management

**Program Director:**

Michael R Lapointe

**Program Manager:**

Carlos H Westhelle

**Project Manager:**

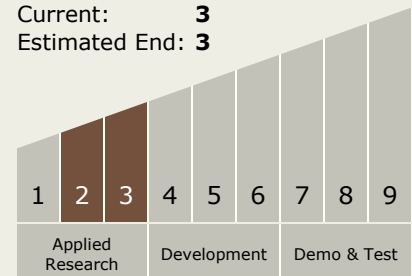
John C Graf

**Principal Investigator:**

John C Graf

## Technology Maturity (TRL)

Start: 2  
 Current: 3  
 Estimated End: 3



## Technology Areas

**Primary:**

- TX11 Software, Modeling, Simulation, and Information Processing
  - └ TX11.1 Software Development, Engineering, and Integrity
    - └ TX11.1.6 Real-time Software